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TRANSMITTAL

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## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☐ Fee Transmittal Form  
(Submit an original, and a duplicate for fee processing)2. ☒ Specification Total Pages 3. ☒ Drawing(s) (35 USC 113) Total Sheets 4. ☒ Oath or Declaration Total Pages a. ☒ Newly executed (original or copy)b. ☐ Unexecuted for information purposesc. ☐ Copy from a prior application (37 CFR 1.63(d))  
(for continuation/divisional with Box 17 completed)  
[Note Box 5 below]i. ☐ DELETION OF INVENTOR(S)  
Signed Statement attached deleting inventor(s)  
named in the prior application, see 37 CFR  
1.63(d)(2) and 1.33(b).5. ☐ Incorporation By Reference (useable if Box 4c is checked)  
The entire disclosure of the prior application, from which a copy of the  
oath or declaration is supplied under Box 4c, is considered as being  
part of the disclosure of the accompanying application and is hereby  
incorporated by reference therein.

## ADDRESS TO:

Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 202316. ☐ Microfiche Computer Program (Appendix)7. Nucleotide and/or Amino Acid Sequence Submission  
(if applicable, all necessary)a. ☐ Computer Readable Copyb. ☐ Paper Copy (identical to computer copy)c. ☐ Statement verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

8. ☒ Assignment Papers (cover sheet & document(s))9. ☐ 37 CFR 3.73(b) Statement ☐ Power of Attorney  
(when there is an assignee)10. ☐ English Translation Document (if applicable)11. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS  
Citations12. ☐ Preliminary Amendment13. ☒ Return Receipt Postcard (MPEP 503)  
(Should be specifically itemized)14. ☐ Small Entity Statement(s) ☐ Statement filed in prior application  
Status still proper and desired15. ☐ Certified Copy of Priority Document(s)  
(if foreign priority is claimed)16. ☐ Other: \_\_\_\_\_  
\_\_\_\_\_  
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17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. \_\_\_\_/\_\_\_\_

## 18. CORRESPONDENCE ADDRESS

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| CLAIMS | (1) FOR  | (2) NUMBER FILED | (3) NUMBER EXTRA              | (4) RATE                      | (5) CALCULATIONS |
|--------|--|------------------|-------------------------------|-------------------------------|------------------|
|        | TOTAL CLAIMS<br>(37 CFR 1.16(c))   | 31-20            | 11                            | X \$ 18.00 =                  | \$ 198.00        |
|        | INDEPENDENT CLAIMS (37 CFR 1.16(b))  | 31-3 =           | 28                            | X \$ 78.00 =                  | \$2184.00        |
|        | MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d))                 |                  |                               | \$260.00 =                    | 0                |
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|        | Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28). |                  |                               |                               |                  |
|        | TOTAL =  |                  |                               |                               | \$3072.00        |

19. Small entity status


- a. ☐ A Small entity statement is enclosed
- b. ☐ A small entity statement was filed in the prior non-provisional application and such status is still proper and desired.
- c. ☐ Is no longer claimed.

20. ☒ A check in the amount of \$3072.00 to cover the filing fee is enclosed.

21. ☒ A check in the amount of \$40.00 to cover the recordal fee is enclosed.

22. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 06-1205:

- a. ☒ Fees required under 37 CFR 1.16.
- b. ☒ Fees required under 37 CFR 1.17.
- c. ☐ Fees required under 37 CFR 1.18.

| SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED |  |
|---|--|
| NAME  | Leonard P. Diana (Reg. No. 29,296)   |
| SIGNATURE   |  |
| DATE  | June 19, 2000  |

## TITLE OF THE INVENTION

## IMAGE COMMUNICATION APPARATUS AND METHOD

5

## FIELD OF THE INVENTION

This invention relates to an image communication apparatus such as a facsimile apparatus, and to an image communication method.

10

## BACKGROUND OF THE INVENTION

In transmission of an image by a facsimile machine, transmission information such as the date and time and number of pages is added onto the transmitted image as a header or footer in order that the receiving side may readily confirm the sender of the image and the number of pages in the transmission.

In a facsimile machine of the type which stores transmitted data in memory in the form of raw data and transmits the data after it is compressed, a very large memory is required when raw image data is stored. In conventional facsimile machines of this type, therefore, the raw data is stored in memory after it has been compressed. In a case where the aforementioned transmission information is added onto this data,

however, use is made of a procedure in which the data that has been stored in memory is expanded and restored to raw data at the time of transmission, data relating to the transmission information is added onto this raw  
5 data, the resulting data is then compressed again and transmitted after compression.

Since this procedure involves data compression and expansion at the time of transmission, processing takes time. This problem becomes particularly acute when  
10 dealing with a large amount of data.

For example, ITU-T Recommendation T.81 recommends using the JPEG standard as the scheme for encoding a color image. If transmission information is added onto a color image, therefore, the conventional technique  
15 requires a procedure involving expanding data that has undergone JPEG compression, adding on a transmission header and then performing compression again. However, color image data involves much more data as compared with monochrome image data and compression/expansion of  
20 this data takes too much time. This conventional technique is not very practical for this reason.

#### SUMMARY OF THE INVENTION

25 Accordingly, an object of the present invention is to provide an image communication apparatus and method

in which when transmission information is added onto an image and then transmitted with the image, memory can be conserved and transmit processing shortened.

According to the present invention, the foregoing  
5 object is attained by providing an image communication apparatus comprising: means for reading an image and generating image data representing the image; means for adding transmission information onto the image data; means for compressing the image data onto which the  
10 transmission information has been added and storing the compressed image data in memory; and means for transmitting the image data that has been stored in the memory.

According to the present invention, the foregoing  
15 object is attained by providing an image communication apparatus comprising: means for adding transmission information onto image data that has been entered; means for compressing the image data onto which the transmission information has been added and storing the  
20 compressed image data in memory; and means for transmitting the image data that has been stored in the memory.

According to the present invention, the foregoing  
object is attained by providing an image communication  
25 apparatus comprising: means for reading an image and successively storing image data representing the image

in a buffer; means for extracting the image data from  
the buffer in prescribed area units of the image; means  
for determining whether transmission information is to  
be added onto each item of image data extracted; means  
5 for adding the transmission information onto the image  
data that has been determined to have this information  
added to it; means for compressing the image data in the  
area units and storing the compressed image data in  
memory; and means for transmitting the image data that  
10 has been stored in the memory.

According to the present invention, the foregoing  
object is attained by providing an image communication  
apparatus comprising: means for reading an image and  
generating image data representing the image; means for  
15 adding transmission information onto the image data;  
means for compressing the image data onto which the  
transmission information has been added and preserving  
the compressed image data; and means for transmitting  
the image data that has been preserved.

20 According to the present invention, the foregoing  
object is attained by providing an image communication  
apparatus comprising: means for reading an image and  
generating image data representing the image; means for  
adding transmission information onto the image data;  
25 means for compressing the image data onto which the  
transmission information has been added and storing the

compressed image data in memory; and means for transmitting the image data that has been stored in the memory without expanding or compressing the image data.

According to the present invention, the foregoing  
5 object is attained by providing an image communication method comprising the steps of: adding transmission information onto image data representing an image that has been read; compressing the image data onto which the transmission information has been added and storing the  
10 compressed image data in memory; and transmitting the image data that has been stored in the memory.

According to the present invention, the foregoing  
object is attained by providing an image communication method comprising the steps of: adding transmission  
15 information onto image data that has been entered; compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and transmitting the image data that has been stored in the memory.

20 According to the present invention, the foregoing object is attained by providing an image communication method having a reading step of reading an image and generating image data representing the image; a storage step of compressing the image data and storing the  
25 compressed image data in the memory; and a transmitting step of transmitting the image data that has been stored

in memory; the method further including a step of adding transmission information onto the image data after the reading step and before the storage step.

According to the present invention, the foregoing  
5 object is attained by providing an image communication method comprising the steps of: reading an image and successively storing image data representing the image in a buffer; extracting the image data from the buffer in prescribed area units of the image; determining  
10 whether transmission information is to be added onto each item of image data extracted; adding the transmission information onto the image data that has been determined to have this information added to it; compressing the image data in the area units and storing  
15 the compressed image data in memory; and transmitting the image data that has been stored in the memory.

According to the present invention, the foregoing object is attained by providing an image communication method comprising the steps of: adding transmission  
20 information onto image data representing an image that has been read; compressing the image data onto which the transmission information has been added and preserving the compressed image data; and transmitting the image data that has been preserved.

25 According to the present invention, the foregoing object is attained by providing an image communication



method comprising the step of: adding transmission information onto image data representing an image that has been read; compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and transmitting the image data that has been stored in the memory without expanding or compressing the image data.

According to the present invention, the foregoing object is attained by providing a storage medium storing a program for causing a computer to function as the following means in an image communication apparatus in order to transmit image data: means for adding transmission information onto the image data; means for compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and means for transmitting the image data that has been stored in the memory.

According to the present invention, the foregoing object is attained by providing a storage medium storing a program for causing a computer to function as the following means in an image communication apparatus in order to transmit image data that has been entered: means for adding transmission information onto the image data; means for compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and means for

transmitting the image data that has been stored in the memory.

According to the present invention, the foregoing object is attained by providing a storage medium storing  
5 a program for causing a computer to function as the following means in an image communication apparatus, which has means for reading an image and successively storing image data representing the image in a buffer, in order to transmit the image data: means for  
10 extracting the image data from the buffer in prescribed area units of the image; means for determining whether transmission information is to be added onto each item of image data extracted; means for adding the transmission information onto the image data that has  
15 been determined to have this information added to it; means for compressing the image data in the area units and storing the compressed image data in memory; and means for transmitting the image data that has been stored in memory.

20 According to the present invention, the foregoing object is attained by providing a storage medium storing a program for causing a computer to function as the following means in order to transmit image data that has been entered: means for adding transmission information  
25 onto the image data; means for compressing the image data onto which the transmission information has been

added and preserving the compressed image data; and means for transmitting the image data that has been preserved.

According to the present invention, the foregoing  
5 object is attained by providing a storage medium storing a program for causing a computer to function as the following means in order to transmit image data that has been entered: means for adding transmission information onto the image data; means for compressing the image  
10 data onto which the transmission information has been added and storing the compressed image data in memory; and means for transmitting the image data that has been stored in the memory without expanding or compressing the image data.

15 According to the present invention, the foregoing object is attained by providing an image communication apparatus comprising: means for reading an image and generating image data representing the image; means for compressing the image data and adding on a marker that  
20 is for adding on transmission information; means for storing the compressed image data in memory; and means for detecting the marker from the image data that has been stored in memory, replacing, on the basis of a position at which the marker resides, some of the image  
25 data with data relating to transmission information, this data having been compressed according to a

compression format identical with that of the image data, and transmitting this image data.

According to the present invention, the foregoing object is attained by providing an image communication apparatus comprising: means for compressing image data that has been entered and adding on a marker that is for adding on transmission information; means for storing the compressed image data in memory; and means for detecting the marker from the image data that has been stored in memory and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information.

According to the present invention, the foregoing object is attained by providing an image communication apparatus comprising: means for reading an image and successively storing image data representing the image in a buffer; means for extracting the image data from the buffer in prescribed area units of the image; means for compressing each item of image data that has been extracted and adding on a marker that is for adding on transmission information; means for storing the compressed image data in memory; and means for detecting the marker from the image data that has been stored in memory and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information.

According to the present invention, the foregoing object is attained by providing an image communication apparatus comprising: means for reading an image and generating image data representing the image; means for  
5 compressing the image data and adding on a marker that is for adding on transmission information; means for preserving the compressed image data; and means for detecting the marker from the preserved image data and replacing, on the basis of a position at which the  
10 marker resides, some of the image data with data relating to transmission information.

According to the present invention, the foregoing object is attained by providing an image communication apparatus comprising: means for reading an image and  
15 generating image data representing the image; means for compressing the image data and adding on a marker that is for adding on transmission information; means for storing the compressed image data in memory; and means for detecting the marker from the image data that has  
20 been stored in memory, replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information, and transmitting this image data without expanding or compressing it.

25 According to the present invention, the foregoing object is attained by providing an image communication

method comprising the steps of: compressing image data that has been read and adding on a marker that is for adding on transmission information; storing the compressed image data in memory; and detecting the  
5 marker from the image data that has been stored in memory, and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information.

According to the present invention, the foregoing  
10 object is attained by providing an image communication method comprising the steps of: compressing image data that has been entered and adding on a marker that is for adding on transmission information; storing the compressed image data in memory; and detecting the  
15 marker from the image data that has been stored in memory, and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information.

According to the present invention, the foregoing  
20 object is attained by providing an image communication method comprising the steps of: reading an image and successively storing image data representing the image in a buffer; extracting the image data from the buffer in prescribed area units of the image; compressing each  
25 item of image data that has been extracted and adding on a marker that is for adding on transmission information;

storing the compressed image data in memory; and  
detecting the marker from the image data that has been  
stored in memory and replacing, on the basis of a  
position at which the marker resides, some of the image  
5 data with data relating to transmission information.

According to the present invention, the foregoing  
object is attained by providing an image communication  
method comprising the steps of: compressing image data  
that has been read and adding on a marker that is for  
10 adding on transmission information; preserving the  
compressed image data; and detecting the marker from the  
preserved image data and replacing, on the basis of a  
position at which the marker resides, some of the image  
data with data relating to transmission information.

15 According to the present invention, the foregoing  
object is attained by providing an image communication  
method comprising the steps of: compressing image data  
that has been read and adding on a marker that is for  
adding on transmission information; storing the  
20 compressed image data in memory; and detecting the  
marker from the image data that has been stored in  
memory, replacing, on the basis of a position at which  
the marker resides, some of the image data with data  
relating to transmission information, and transmitting  
25 this image data without expanding or compressing it.

According to the present invention, the foregoing

object is attained by providing a storage medium storing  
a program for causing a computer to function as the  
following means in an image communication apparatus in  
order to transmit image data: means for compressing the  
5 image data and adding on a marker that is for adding on  
transmission information; means for storing the  
compressed image data in memory; and means for detecting  
the marker from the image data that has been stored in  
memory, and replacing, on the basis of a position at  
10 which the marker resides, some of the image data with  
data relating to transmission information.

According to the present invention, the foregoing  
object is attained by providing a storage medium storing  
a program for causing a computer to function as the  
15 following means in an image communication apparatus in  
order to transmit image data that has been entered:  
means for compressing image data that has been entered  
and adding on a marker that is for adding on  
transmission information; means for storing the  
20 compressed image data in memory; and means for detecting  
the marker from the image data that has been stored in  
memory and replacing, on the basis of a position at  
which the marker resides, some of the image data with  
data relating to transmission information.

25 According to the present invention, the foregoing  
object is attained by providing a storage medium storing



a program for causing a computer to function as the following means in an image communication apparatus, which has means for reading an image and successively storing image data representing the image in a buffer, 5 in order to transmit the image data: means for extracting the image data from the buffer in prescribed area units of the image; means for compressing each item of image data that has been extracted and adding on a marker that is for adding on transmission information; 10 means for storing the compressed image data in memory; and means for detecting the marker from the image data that has been stored in memory and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission 15 information.

According to the present invention, the foregoing object is attained by providing a storage medium storing a program for causing a computer to function as the following means in an image communication apparatus in 20 order to transmit image data that has been entered: means for compressing the image data and adding on a marker that is for adding on transmission information; means for preserving the compressed image data; and means for detecting the marker from the preserved image 25 data and replacing, on the basis of a position at which the marker resides, some of the image data with data

relating to transmission information.

According to the present invention, the foregoing object is attained by providing a storage medium storing a program for causing a computer to function as the

5 following means in an image communication apparatus in order to transmit image data: means for compressing the image data and adding on a marker that is for adding on transmission information; means for storing the compressed image data in memory; and means for detecting

10 the marker from the image data that has been stored in the memory, replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information, and transmitting this image data without expanding or

15 compressing it.

Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which like reference characters designate

20 the same or similar parts throughout the figures thereof.

#### BRIEF DESCRIPTION OF THE DRAWINGS

25 The accompanying drawings, which are incorporated in and constitute a part of the specification,

illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

Fig. 1 is a block diagram showing the overall  
5 construction of a facsimile machine according to an embodiment of the present invention;

Fig. 2 is a diagram showing the construction of a control panel;

Fig. 3 is a block diagram illustrating processing  
10 for transmitting monochrome image data according to the prior art;

Fig. 4 is a block diagram useful in describing processing for transmitting image data by a first technique according to an embodiment of the present  
15 invention;

Fig. 5 is a flowchart of processing according to the first technique;

Fig. 6 is a block diagram useful in describing processing for transmitting image data by a second  
20 technique according to an embodiment of the present invention;

Fig. 7 is a diagram useful in describing the data structure of JPEG baseline-encoded data according to the second technique; and

25 Fig. 8 is a flowchart of processing according to the second technique.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will now be described in detail in accordance with the accompanying drawings.

5        Fig. 1 is a block diagram showing the overall construction of a facsimile machine serving as an image communication apparatus according to an embodiment of the present invention. This facsimile machine has a G3 facsimile function, is used upon being connected to an  
10 analog telephone line and is capable of sending and receiving color images.

As shown in Fig. 1, the facsimile machine includes a CPU 101 for controlling the overall apparatus; a ROM 102 for storing programs such as the control program of the facsimile machine; a RAM 103 constituted by an SRAM  
15 or the like and used as a working memory for storing the program control variables of the facsimile machine and set values registered by the operator; an image memory 104 constituted by a DRAM or the like for storing image  
20 data; an image processor 105 for subjecting read image data to edge enhancement, a luminance/density conversion and a multilevel/bilevel conversion, etc; a control panel 106 for setting the mode and displaying the status of the facsimile machine; a recording controller 107 for  
25 converting the bilevel data to a native command for recording; a compression/expansion unit 108 for

subjecting image data to compression/expansion in accordance with the JPEG or JBIG standard; a PC interface 109 for controlling an interface with a host computer 118, which is an external terminal; a  
5 bidirectional interface 110 for controlling the sending and receiving of data in two directions between the facsimile machine and the host computer 118; and a reading controller 111 for controlling the motor of a sheet scanner 112 when reading is performed.

10       The sheet scanner 112 is of the sheet-through type and is constituted by a CS/CCD image sensor, a reading motor, etc.

          The facsimile machine further includes a line buffer 113 used when image data output from the image  
15 processor 105 is transferred to the image memory 104; a printer interface 114 for analyzing print description language and effecting a conversion to image data; a printer 115 for printing a read image, a received image and file data, etc., on printing paper; a communication  
20 controller 116 for performing mutual communication with another communication apparatus; and a timekeeping unit 117 for measuring operating intervals, etc. The host computer 118 configures the operation of the facsimile machine, monitors the status of the facsimile machine  
25 and manages image data read by and image data received by the facsimile machine. A public communication line

119 allows the facsimile machine to communicate with another communication apparatus.

Fig. 2 illustrates the control panel 106 of this facsimile machine.

5       As shown in Fig. 2, the control panel 106 includes numeric keys 201 for entering a telephone number and for making various settings; a display unit 202 for displaying status information and operating state of the facsimile machine; single-touch keys 203 for entering a  
10   telephone number and for making various settings; a start key 204 for starting copying, communication or scanning, etc; a color/monochrome changeover key 205 for switching between color reading and monochrome reading; a resolution key 206 for switching reading resolution; a  
15   hook key 207 for acquiring and releasing a line; a stop key 208 for halting various operations and cancelling registration; a redial/pause key 209 for redialing a telephone number or inserting a pause in dialing; an abbreviated dialing key 210 for dialing a registered  
20   telephone number through an abbreviated procedure; a receive-mode changeover key 211 for changing over the receive mode; a copy key 212 for changing the mode to the copy mode; a function key 213 for changing the mode to various set modes of the facsimile machine; a setting  
25   key 214 for finalizing various settings; a recovery key 215 for error recovery; a color/monochrome operation

display lamp 216 which is lit (turns ON) if the current reading operation is for color and which is extinguished (turned OFF) if the current reading operation is for monochrome; and an error display lamp 217 which, if any  
5 component of the facsimile machine malfunctions, gives notification of this event.

The operation of the facsimile machine constructed as set forth above will be described below.

In order to clarify the characterizing features of  
10 the facsimile machine according to this embodiment, processing for transmitting image data according to the prior art will be described first.

Fig. 3 is a block diagram useful in describing processing for transmitting monochrome image data  
15 according to the prior art, especially processing for adding on a header as transmission information.

First, an image is read by a scanner (31), analog signals that have been separated into black and white are converted to digital data of one bit per pixel, and  
20 then the digital data is stored successively in a buffer (32). The image data that has been stored in the buffer is output to an image memory (33) upon being compressed. Compression is required because outputting the raw data as is would require an extremely large memory.

25 Thereafter, the image data that has been stored in the image memory is expanded one line at a time in order

to add on a header. After the header is added on, the image data is compressed again, subsequently modulated by a modem (34) and then transmitted to the line (35) from an NCU 35.

5 In accordance with this procedure, the transmission of image data is accompanied by expansion and then re-compression of the image data. As a consequence, processing time is prolonged.

Two forms of processing for transmitting image data  
10 by the facsimile machine according to this embodiment will be described next.

Fig. 4 is a block diagram useful in describing processing for transmitting image data according to a first technique, especially processing for adding a  
15 header to color image data as transmission information.

First, an image is read by the sheet scanner 112 (41) and digital image data that has been separated into the three primary colors R, G, B and consists of eight bits per color is stored successively in the line buffer  
20 113 (42). Next, data representing a header that has been converted to eight bits per R, G, B is added onto the raw data that has been stored in the line buffer 113. The image data to which the header has been added is compressed as is (to the JPEG format) and then stored  
25 in the image memory 104 (43). Thereafter, without being expanded and then re-compressed, the image data that has



been stored in the image memory 104 is transmitted to another facsimile machine or the like upon being modulated (44) by a modem in the communication controller 116 and sent to the line (45) by the NCU.

5        This procedure will now be described in greater detail with reference to Fig. 5, which is a flowchart of processing according to the first technique for adding on a header when an image is read.

At step S501, date and time (e.g., the date and  
10    time at which reading by the sheet scanner 112 starts), page number (the number of pages from the first page) and the like are set in a header buffer (not shown) as transmission information that appears in a header stored in the RAM 103, etc.

15        This is followed by step S502, at which it is determined whether image data that has been stored in the line buffer 113 is the end of one page of data, i.e., whether data in excess of one MCU (Minimum Coded Unit) line has been stored in the line buffer 113. If  
20    one page of data has been completed ("YES" at step S502), control proceeds to step S507 and processing is exited. If one page of data has not been completed ("NO" at step S502), then control proceeds to step S503, at which data of one MCU line is extracted from the line  
25    buffer 113.

The number of lines referred to as "one MCU line"

depends upon subsampling in JPEG compression processing.  
For example, in a case where processing is executed at a  
subsampling ratio of 4:1:1, data of 16 x 16 pixels will  
be necessary. The smallest processing unit in terms of  
5 such JPEG processing is referred to as the MCU. Since a  
contact sensor or the like in a facsimile machine  
performs line-sequential scanning, in this embodiment  
JPEG processing is executed in units of MCU lines (16  
lines in case of 4:1:1 subsampling), which is a state in  
10 which the MCUs are arranged one column wide.

Next, at step S504, it is determined whether the  
extracted MCU line is a line to which a header is to be  
added. In regard to an MCU line to which a header is  
not be added ("NO" at step S504), control proceeds to  
15 step S506, at which the data is subjected to JPEG  
decompression as is and then stored in the image memory  
104. In regard to an MCU line to which a header is to  
be added ("YES" at step S504), control proceeds to step  
S505, at which processing for adding on a header is  
20 executed.

A specific example of the method used at step S505  
involves first referring to a character code set in the  
header buffer by the processing of step S501 and then  
expanding the code by CG expansion executed in a CG  
25 expansion unit. This data is converted to data  
consisting of eight bits per each of the R, G, B color

components, which is written over the data of one MCU  
line extracted from the line buffer 113. This is  
followed by subjecting this one MCU line to JPEG  
compression (step S506) and storing the compressed image  
5 data in the image memory 104.

The image data that has been stored in the image  
memory 104 is subsequently transmitted without being  
expanded and re-compressed.

Thus, in accordance with the first technique of  
10 this embodiment, when a color image is transmitted, JPEG  
compression is applied after the header is added on at  
reading of the data, the compressed data is stored in  
the image memory and then is transmitted as is. As a  
result, conservation of the image memory is achieved and  
15 processing at transmission time required heretofore,  
namely expansion followed by re-compression, is  
eliminated. This makes it possible to shorten  
transmission time.

Processing for transmitting image data according to  
20 a second technique of this embodiment will now be  
described.

Fig. 6 is a block diagram useful in describing  
processing for adding a header to color image data as  
transmission information.

25 First, an image is read by the sheet scanner 112  
(61) and digital image data that has been separated into

the three primary colors R, G, B and consists of eight bits per color is stored successively in the line buffer 113 (62). When the stored raw data is subjected to JPEG compression and then stored in the image memory 104

5 (63), compression processing is executed. This processing involves adding a marker referred to as a "restart marker" to the end of one MCU line. A restart marker primarily is used in order to minimize the influence of invalid data such as communication data  
10 error. Sensing the end of one MCU line in a JPEG compression code is difficult. The purpose of this compression processing is to solve this problem by using the restart marker.

With regard to the transmission of image data,  
15 first raw data representing a header is generated. Next, image data is extracted from the image memory 104, the restart marker added on previously is searched for and, on the basis of the position of this marker, the image data of the MCU line to which the header is to be  
20 added is discarded. The raw data of the header created previously is subjected to JPEG compression in a format identical with that of the already compressed image data upon referring to the JPEG header portion (the portion describing the image compression conditions and the  
25 like) that has been added onto the already compressed image data (the JPEG header portion having been stored

in the image memory 104). By inserting this JPEG-decompressed data in the portion discarded earlier, the inclusion of the header is realized.

Thereafter, without being expanded and then recompressed, the image data is transmitted to another facsimile machine or the like upon being modulated (64) by a modem in the communication controller 116 and sent to the line (65) by the NCU.

Fig. 7 is a diagram illustrating the data structure when a header is added on in accordance with the second technique shown in Fig. 6. One page of JPEG baseline-encoded data stipulated by Recommendation T.81 of ITU-TT4 is composed of an image frame between SOI (Start of Image) and EOI (End of Image) markers. The image frame is divided into a so-called JPEG header portion such as APP1, DQT, DHT, etc., and a JPEG compressed-data portion that begins with the SOS marker. As shown in Fig. 7, restart markers are inserted following the one-MCU line compression codes. When data is transmitted, one MCU line is sensed using these markers as guides and the JPEG compression codes of the header are substituted, as set forth earlier.

Fig. 8 is a flowchart of processing according to the second technique for adding on a header when an image is transmitted.

At step S801, date and time, page number and the

like constituting transmission information to appear in the header stored in the RAM 103 or the like are set in a header buffer (not shown).

Next, at step S802, a transmission-information  
5 header which is raw image data of eight bits per each of the color components R, G, B is created by a method similar to that of step S505 shown in Fig. 5.

This is followed by step S803, at which a restart  
10 marker is found among the JPEG compression codes of image data, to which start markers were added through the technique described above, and which has been stored in the image memory 104. An MCU line to which a header is to be added is detected based upon the marker at step S804.

15 The data constituting the header created at step S802 is subjected to JPEG compression (step S805), in accordance with a format similar to that of the data that has been stored in the image memory, upon referring to the JPEG header portion in the data structure of Fig.  
20 7, and this is substituted (step S806) for the MCU line detected at step S804.

This image data is subsequently transmitted without being expanded and re-compressed.

Thus, in accordance with the second technique of  
25 this embodiment, when image data is compressed, a marker is added on and the image data is stored in an image

memory. When this image data is transmitted, the marker is found and a header is added on as transmission information. As a result, conservation of the image memory is achieved and processing at transmission time required heretofore, namely expansion followed by re-compression, is eliminated. This makes it possible to shorten transmission time.

Furthermore, since the header is added on at the time of image data transmission in a manner similar to that of the prior art, accurate information such as communication starting time and total number of pages can be set forth in the header.

Furthermore, it goes without saying that the object of the invention is attained also by supplying a storage medium storing the program codes of the software for performing the functions of the foregoing embodiment to a system or an apparatus, reading the program codes with a computer (e.g., a CPU or MPU) of the system or apparatus from the storage medium, and then executing the program codes.

In this case, the program codes read from the storage medium implement the novel functions of the embodiment, and the storage medium storing the program codes constitutes the invention.

Furthermore, besides the case where the aforesaid functions according to the embodiment are implemented by

executing the program codes read by a computer, it goes without saying that the present invention covers a case where an operating system or the like running on the computer performs a part of or the entire process in accordance with the designation of program codes and implements the functions according to the embodiment.

It goes without saying that the present invention further covers a case where, after the program codes read from the storage medium are written in a function expansion board inserted into the computer or in a memory provided in a function expansion unit connected to the computer, a CPU or the like contained in the function expansion board or function expansion unit performs a part of or the entire process in accordance with the designation of program codes and implements the function of the above embodiment.

In a case where the present invention is applied to a storage medium, program code corresponding to the flowchart of Fig. 5 or Fig. 8 described earlier would be stored on the storage medium.

As many apparently widely different embodiments of the present invention can be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.



WHAT IS CLAIMED IS:

1. An image communication apparatus comprising:
  - means for reading an image and generating image data representing the image;
  - 5 means for adding transmission information onto the image data;
  - means for compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and
  - 10 means for transmitting the image data that has been stored in the memory.
2. An image communication apparatus comprising:
  - means for adding transmission information onto image data that has been entered;
  - 15 means for compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and
  - means for transmitting the image data that has been stored in the memory.
- 20 3. An image communication apparatus comprising:
  - means for reading an image and successively storing image data representing the image in a buffer;
  - means for extracting the image data from the buffer in prescribed area units of the image;
  - 25 means for determining whether transmission information is to be added onto each item of image data

extracted;

means for adding the transmission information onto the image data that has been determined to have this information added to it;

- 5 means for compressing the image data in the area units and storing the compressed image data in memory; and

means for transmitting the image data that has been stored in the memory.

- 10 4. An image communication apparatus comprising:

means for reading an image and generating image data representing the image;

means for adding transmission information onto the image data;

- 15 means for compressing the image data onto which the transmission information has been added and preserving the compressed image data; and

means for transmitting the image data that has been preserved.

- 20 5. An image communication apparatus comprising:

means for reading an image and generating image data representing the image;

means for adding transmission information onto the image data;

- 25 means for compressing the image data onto which the transmission information has been added and storing the

compressed image data in memory; and

means for transmitting the image data that has been stored in the memory without expanding or compressing the image data.

- 5 6. An image communication method comprising the steps of:

adding transmission information onto image data representing an image that has been read;

- 10 compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and

transmitting the image data that has been stored in the memory.

- 15 7. An image communication method comprising the steps of:

adding transmission information onto image data that has been entered;

- 20 compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and

transmitting the image data that has been stored in the memory.

8. An image communication method having a reading step of reading an image and generating image data  
25 representing the image; a storage step of compressing the image data and storing the compressed image data in

memory; and a transmitting step of transmitting the image data that has been stored in the memory;

the method further including a step of adding transmission information onto the image data after the reading step and before the storage step.

9. An image communication method comprising the steps of:

reading an image and successively storing image data representing the image in a buffer;

10 extracting the image data from the buffer in prescribed area units of the image;

determining whether transmission information is to be added onto each item of image data extracted;

adding the transmission information onto the image data that has been determined to have this information added to it;

compressing the image data in the area units and storing the compressed image data in memory; and

transmitting the image data that has been stored in the memory.

10. An image communication method comprising the steps of:

adding transmission information onto image data representing an image that has been read;

25 compressing the image data onto which the transmission information has been added and preserving

the compressed image data; and

transmitting the image data that has been preserved.

11. An image communication method comprising the step

5 of:

adding transmission information onto image data representing an image that has been read;

compressing the image data onto which the transmission information has been added and storing the  
10 compressed image data in memory; and

transmitting the image data that has been stored in the memory without expanding or compressing the image data.

12. A storage medium storing a program for causing a  
15 computer to function as the following means in an image communication apparatus in order to transmit image data:

means for adding transmission information onto the image data;

means for compressing the image data onto which the transmission information has been added and storing the  
20 compressed image data in memory; and

means for transmitting the image data that has been stored in the memory.

13. A storage medium storing a program for causing a  
25 computer to function as the following means in an image communication apparatus in order to transmit image data

that has been entered:

means for adding transmission information onto the image data;

means for compressing the image data onto which the  
5 transmission information has been added and storing the compressed image data in memory; and means for transmitting the image data that has been stored in the memory.

14. A storage medium storing a program for causing a  
10 computer to function as the following means in an image communication apparatus, which has means for reading an image and successively storing image data representing the image in a buffer, in order to transmit the image data:

15 means for extracting the image data from the buffer in prescribed area units of the image;

means for determining whether transmission information is to be added onto each item of image data extracted;

20 means for adding the transmission information onto the image data that has been determined to have this information added to it;

means for compressing the image data in the area units and storing the compressed image data in memory;

25 and

means for transmitting the image data that has been

stored in the memory.

15. A storage medium storing a program for causing a computer to function as the following means in order to transmit image data that has been entered:

5        means for adding transmission information onto the image data;

         means for compressing the image data onto which the transmission information has been added and preserving the compressed image data; and

10       means for transmitting the image data that has been preserved.

16. A storage medium storing a program for causing a computer to function as the following means in order to transmit image data that has been entered:

15       means for adding transmission information onto the image data;

         means for compressing the image data onto which the transmission information has been added and storing the compressed image data in memory; and

20       means for transmitting the image data that has been stored in the memory without expanding or compressing the image data.

17. An image communication apparatus comprising:

         means for reading an image and generating image  
25 data representing the image;

         means for compressing the image data and adding on

a marker that is for adding on transmission information;

means for storing the compressed image data in  
memory; and

means for detecting the marker from the image data  
5 that has been stored in the memory, and replacing, on  
the basis of a position at which the marker resides,  
some of the image data with data relating to  
transmission information.

18. An image communication apparatus comprising:

10 means for compressing image data that has been  
entered and adding on a marker that is for adding on  
transmission information;

means for storing the compressed image data in  
memory; and

15 means for detecting the marker from the image data  
that has been stored in the memory and replacing, on the  
basis of a position at which the marker resides, some of  
the image data with data relating to transmission  
information.

20 19. An image communication apparatus comprising:

means for reading an image and successively storing  
image data representing the image in a buffer;

means for extracting the image data from the buffer  
in prescribed area units of the image;

25 means for compressing each item of image data that  
has been extracted and adding on a marker that is for



adding on transmission information;

means for storing the compressed image data in  
memory; and

means for detecting the marker from the image data  
5 that has been stored in the memory, replacing, on the  
basis of a position at which the marker resides, some of  
the image data with data relating to transmission  
information, this data having been compressed according  
to a compression format identical with that of the image  
10 data, and transmitting this image data.

20. An image communication apparatus comprising:

means for reading an image and generating image  
data representing the image;

means for compressing the image data and adding on  
15 a marker that is for adding on transmission information;

means for preserving the compressed image data; and

means for detecting the marker from the preserved  
image data, replacing, on the basis of a position at  
which the marker resides, some of the image data with  
20 data relating to transmission information, this data  
having been compressed according to a compression format  
identical with that of the image data, and transmitting  
this image data.

21. An image communication apparatus comprising:

25 means for reading an image and generating image  
data representing the image;

means for compressing the image data and adding on  
a marker that is for adding on transmission information;

means for storing the compressed image data in  
memory; and

5 means for detecting the marker from the image data  
that has been stored in the memory, replacing, on the  
basis of a position at which the marker resides, some of  
the image data with data relating to transmission  
information, this data having been compressed according  
10 to a compression format identical with that of the image  
data, and transmitting this image data without expanding  
or compressing it.

22. An image communication method comprising the steps  
of:

15 compressing image data that has been read and  
adding on a marker that is for adding on transmission  
information;

storing the compressed image data in memory; and

20 detecting the marker from the image data that has  
been stored in the memory, and replacing, on the basis  
of a position at which the marker resides, some of the  
image data with data relating to transmission  
information.

23. An image communication method comprising the steps  
25 of:

compressing image data that has been entered and

adding on a marker that is for adding on transmission information;

storing the compressed image data in memory; and

detecting the marker from the image data that has  
5 been stored in the memory, and replacing, on the basis  
of a position at which the marker resides, some of the  
image data with data relating to transmission  
information.

24. An image communication method comprising the steps  
10 of:

reading an image and successively storing image  
data representing the image in a buffer;

extracting the image data from the buffer in  
prescribed area units of the image;

15 compressing each item of image data that has been  
extracted and adding on a marker that is for adding on  
transmission information;

storing the compressed image data in memory; and

detecting the marker from the image data that has  
20 been stored in the memory and replacing, on the basis of  
a position at which the marker resides, some of the  
image data with data relating to transmission  
information.

25. An image communication method comprising the steps  
25 of:

compressing image data that has been read and

adding on a marker that is for adding on transmission information;

preserving the compressed image data; and

detecting the marker from the preserved image data

5 and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information.

26. An image communication method comprising the steps of:

10 compressing image data that has been read and adding on a marker that is for adding on transmission information;

storing the compressed image data in memory; and

15 detecting the marker from the image data that has been stored in the memory, replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information, and transmitting this image data without expanding or compressing it.

20 27. A storage medium storing a program for causing a computer to function as the following means in an image communication apparatus in order to transmit image data:

means for compressing the image data and adding on a marker that is for adding on transmission information;

25 means for storing the compressed image data in memory; and

means for detecting the marker from the image data that has been stored in the memory, and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to  
5 transmission information.

28. A storage medium storing a program for causing a computer to function as the following means in an image communication apparatus in order to transmit image data that has been entered:

10 means for compressing image data that has been entered and adding on a marker that is for adding on transmission information;

means for storing the compressed image data in memory; and

15 means for detecting the marker from the image data that has been stored in the memory and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information.

20 29. A storage medium storing a program for causing a computer to function as the following means in an image communication apparatus, which has means for reading an image and successively storing image data representing the image in a buffer, in order to transmit the image  
25 data:

means for extracting the image data from the buffer

in prescribed area units of the image;

means for compressing each item of image data that has been extracted and adding on a marker that is for adding on transmission information;

5 means for storing the compressed image data in memory; and

means for detecting the marker from the image data that has been stored in the memory and replacing, on the basis of a position at which the marker resides, some of  
10 the image data with data relating to transmission information.

30. A storage medium storing a program for causing a computer to function as the following means in an image communication apparatus in order to transmit image data  
15 that has been entered:

means for compressing the image data and adding on a marker that is for adding on transmission information;

means for preserving the compressed image data; and

means for detecting the marker from the preserved  
20 image data and replacing, on the basis of a position at which the marker resides, some of the image data with data relating to transmission information.

31. A storage medium storing a program for causing a computer to function as the following means in an image communication apparatus in order to transmit image data:  
25

means for compressing the image data and adding on

a marker that is for adding on transmission information;

means for storing the compressed image data in  
memory; and

- means for detecting the marker from the image data
- 5 that has been stored in the memory, replacing, on the  
basis of a position at which the marker resides, some of  
the image data with data relating to transmission  
information, and transmitting this image data without  
expanding or compressing it.

# ABSTRACT OF THE DISCLOSURE

Disclosed are a color facsimile apparatus and method in which when transmission information is added onto an image and then transmitted with the image, memory can be conserved and transmit processing shortened. A color image is read and image data represented the read image is generated. The image is then compressed in the form of "JPEG" and stored in memory. In the transmission of the image data that has been stored in memory, transmission information is added onto the image data before the image data is subjected to JPEG compression. When the image data is transmitted, therefore, processing for expanding the image and then re-compressing the data can be eliminated.



FIG. 1

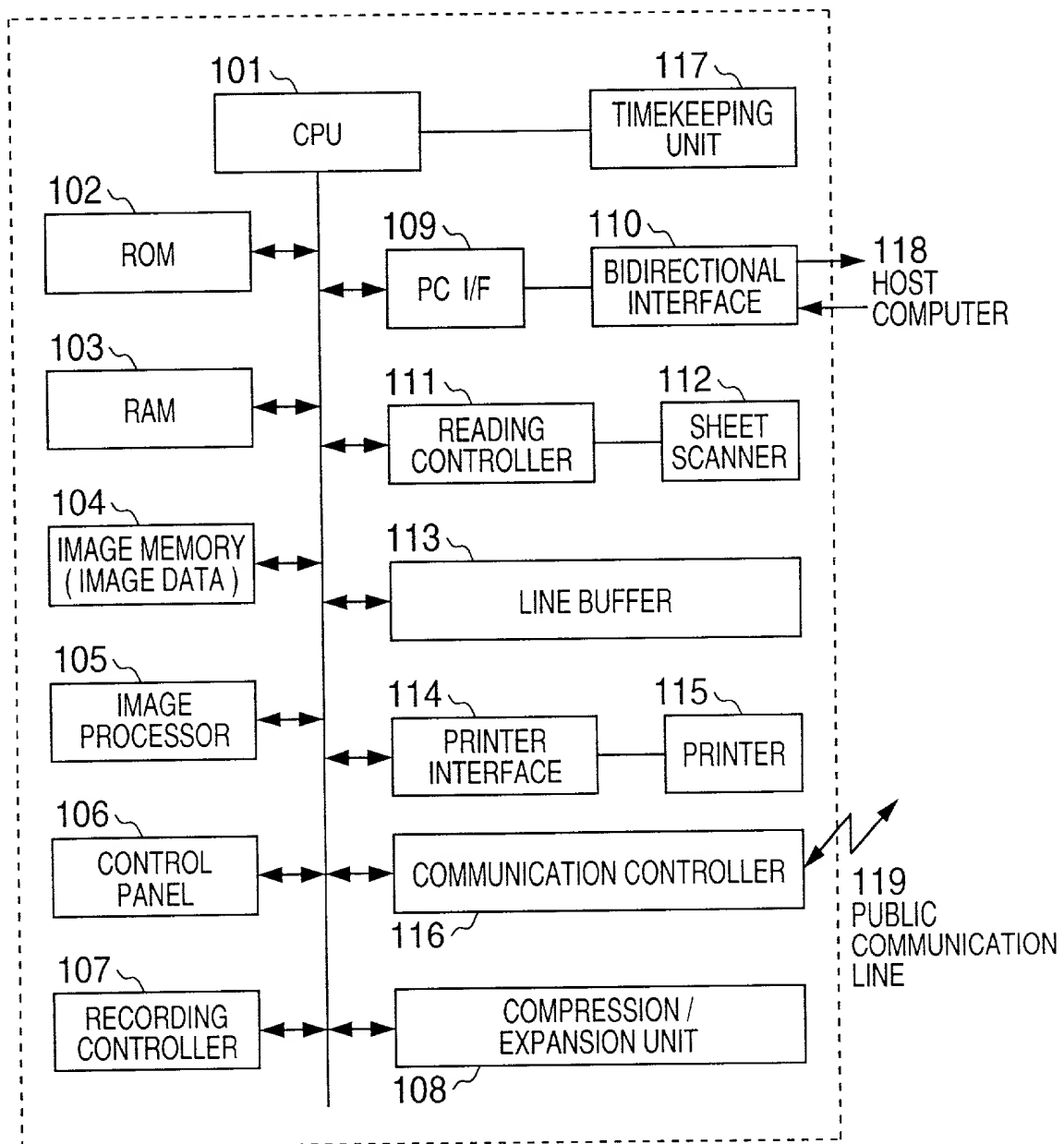
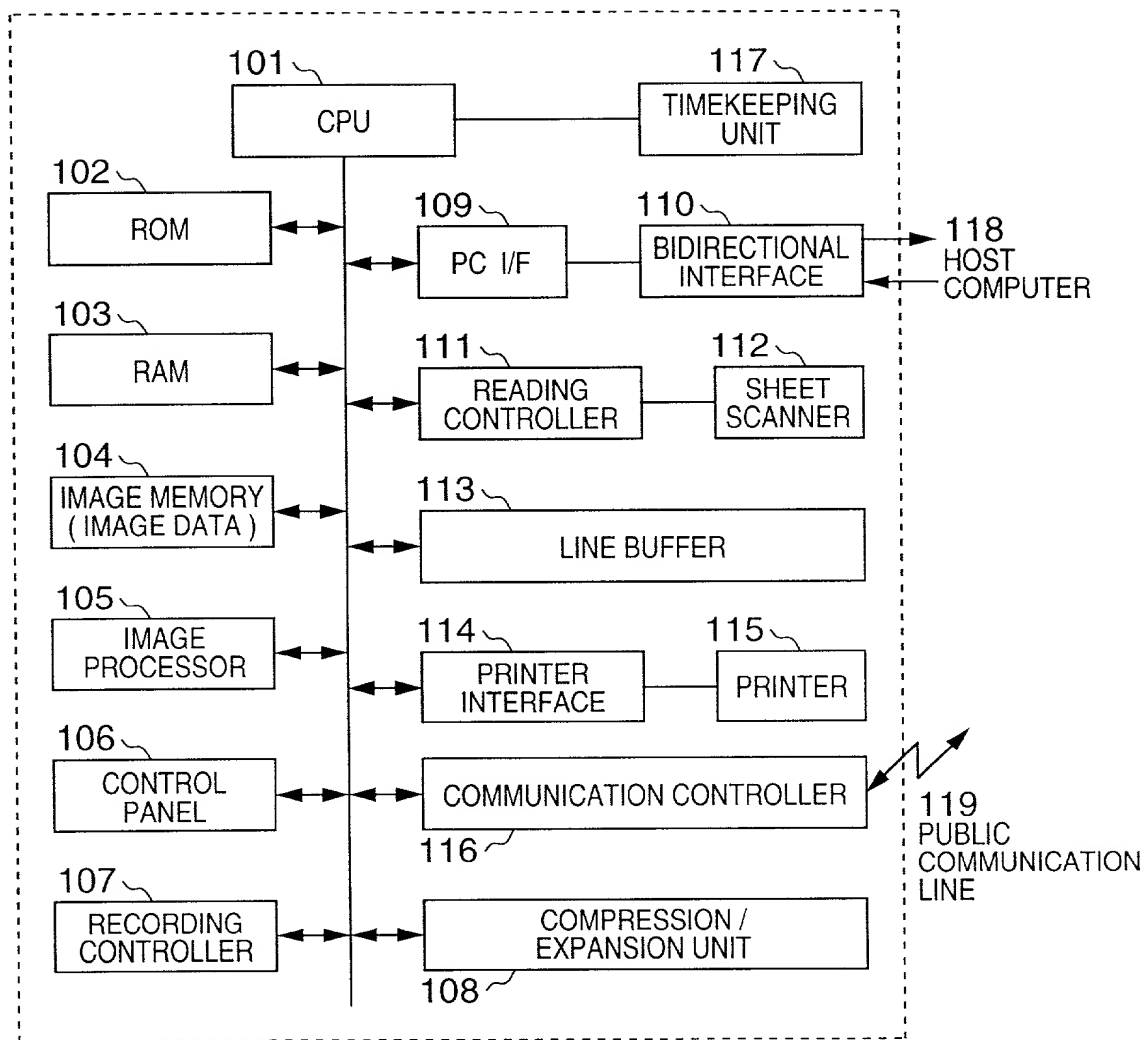
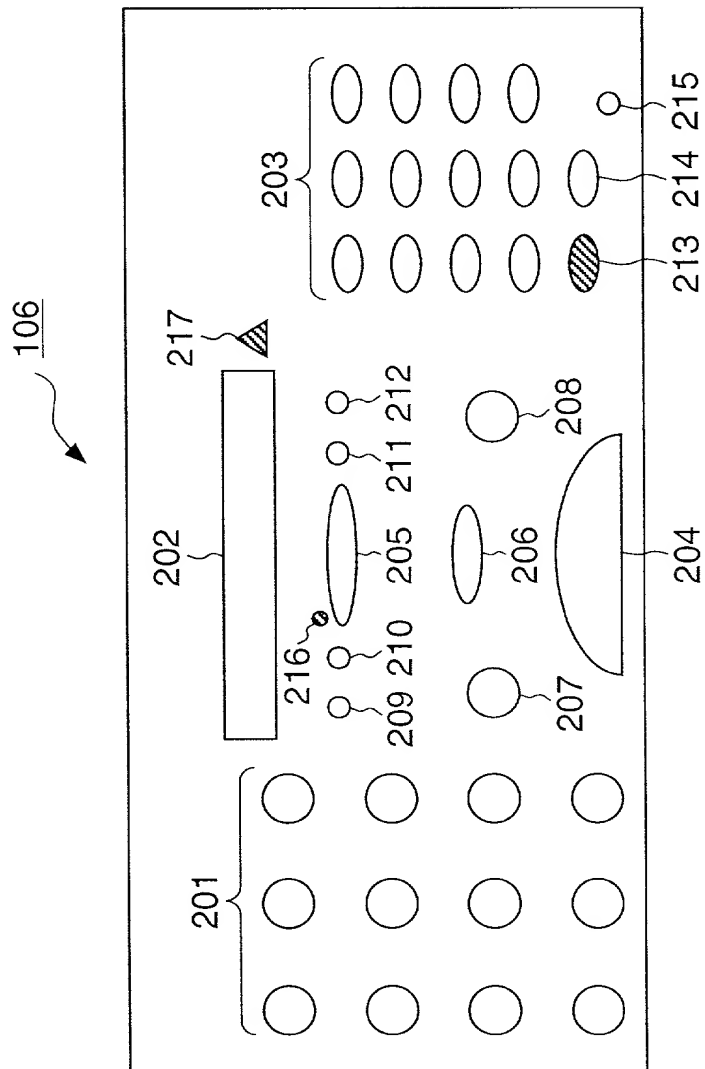


FIG. 1



## FIG. 2



**FIG. 3**  
(PRIOR ART)

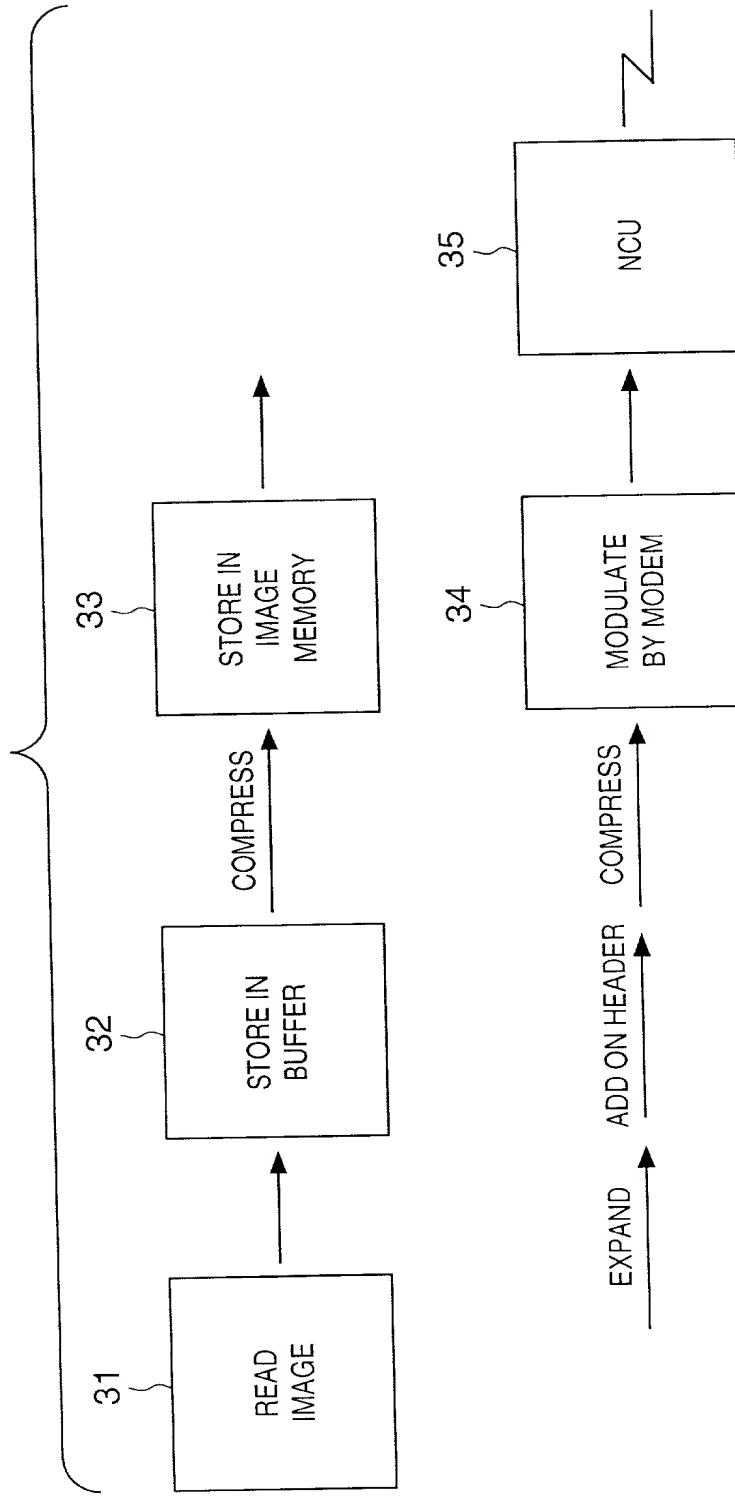
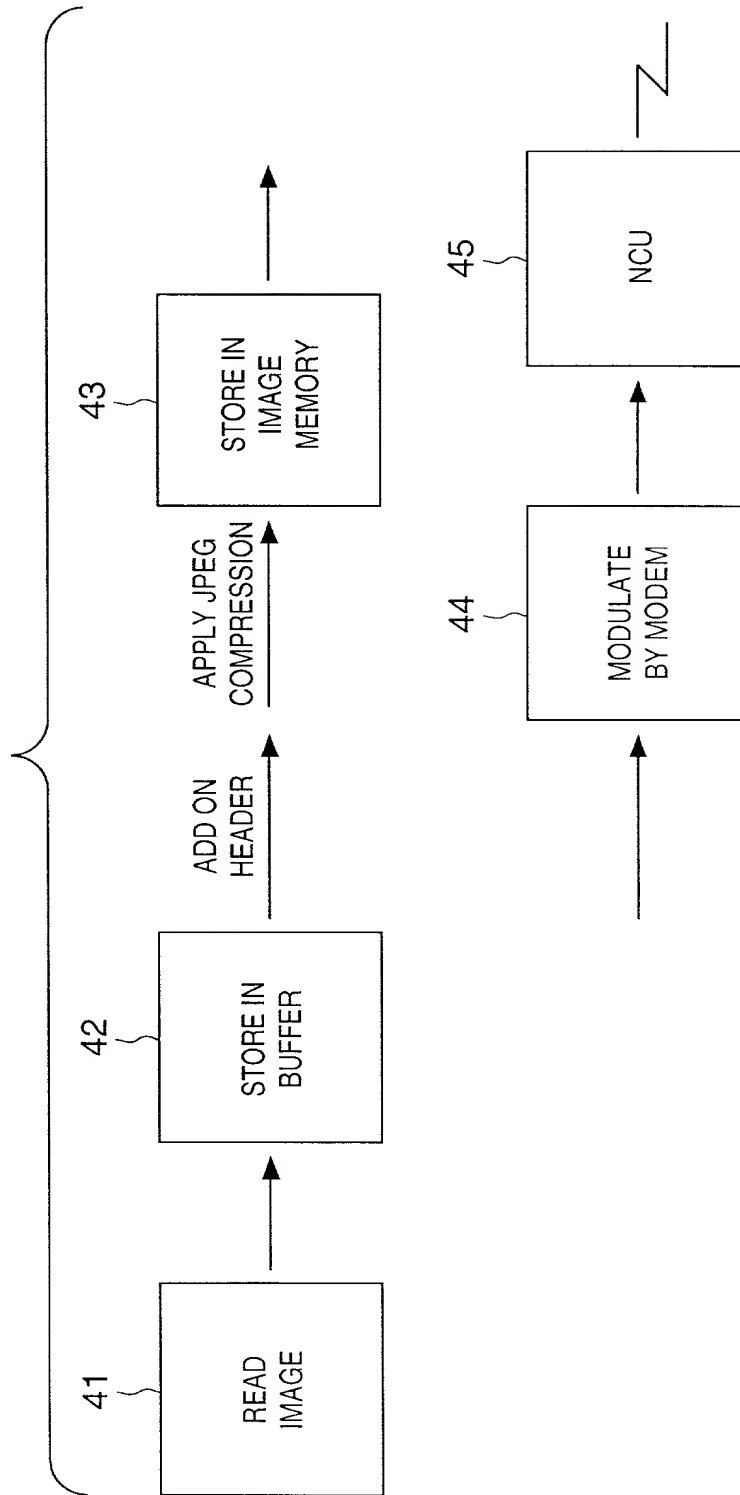


FIG. 4



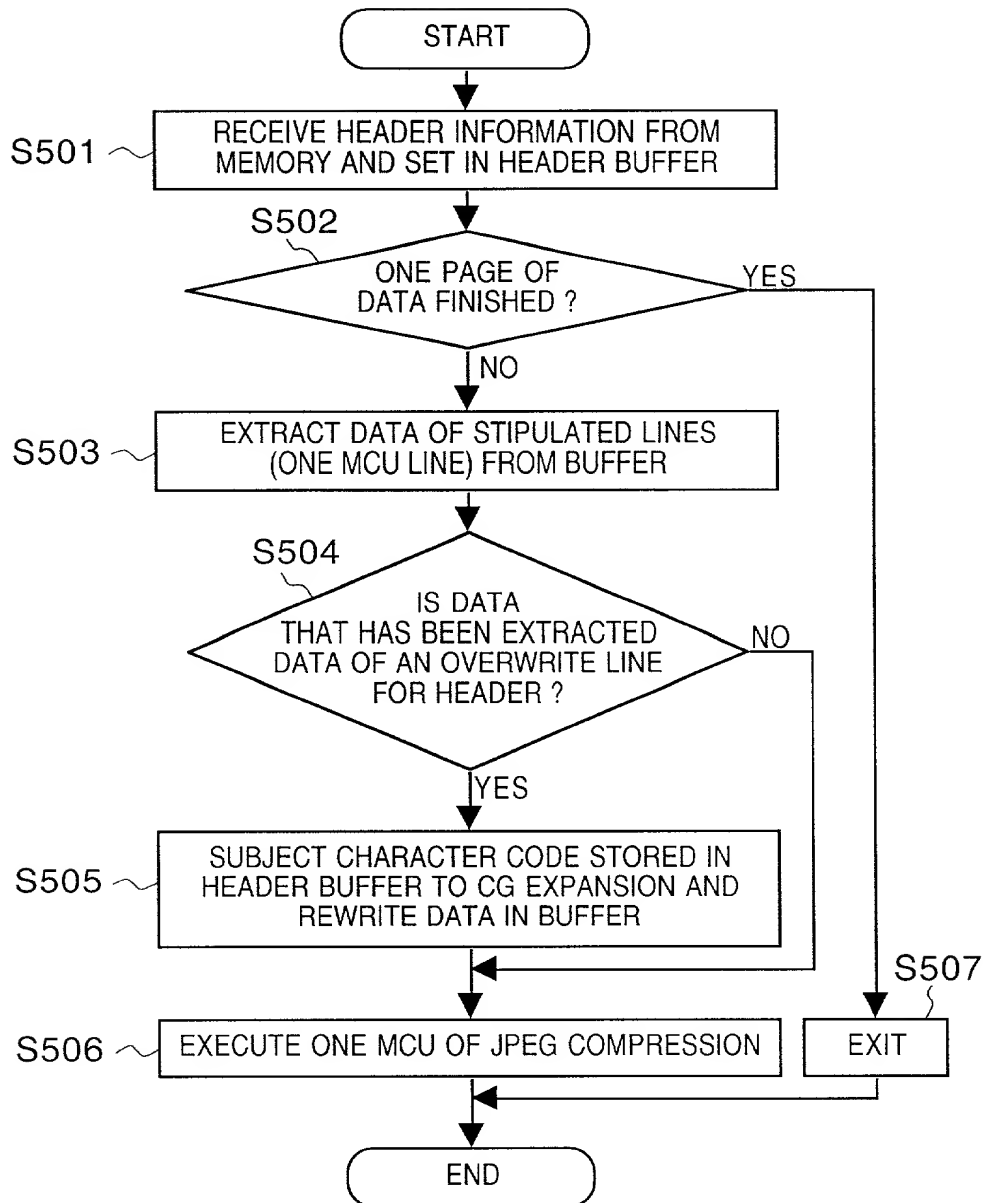
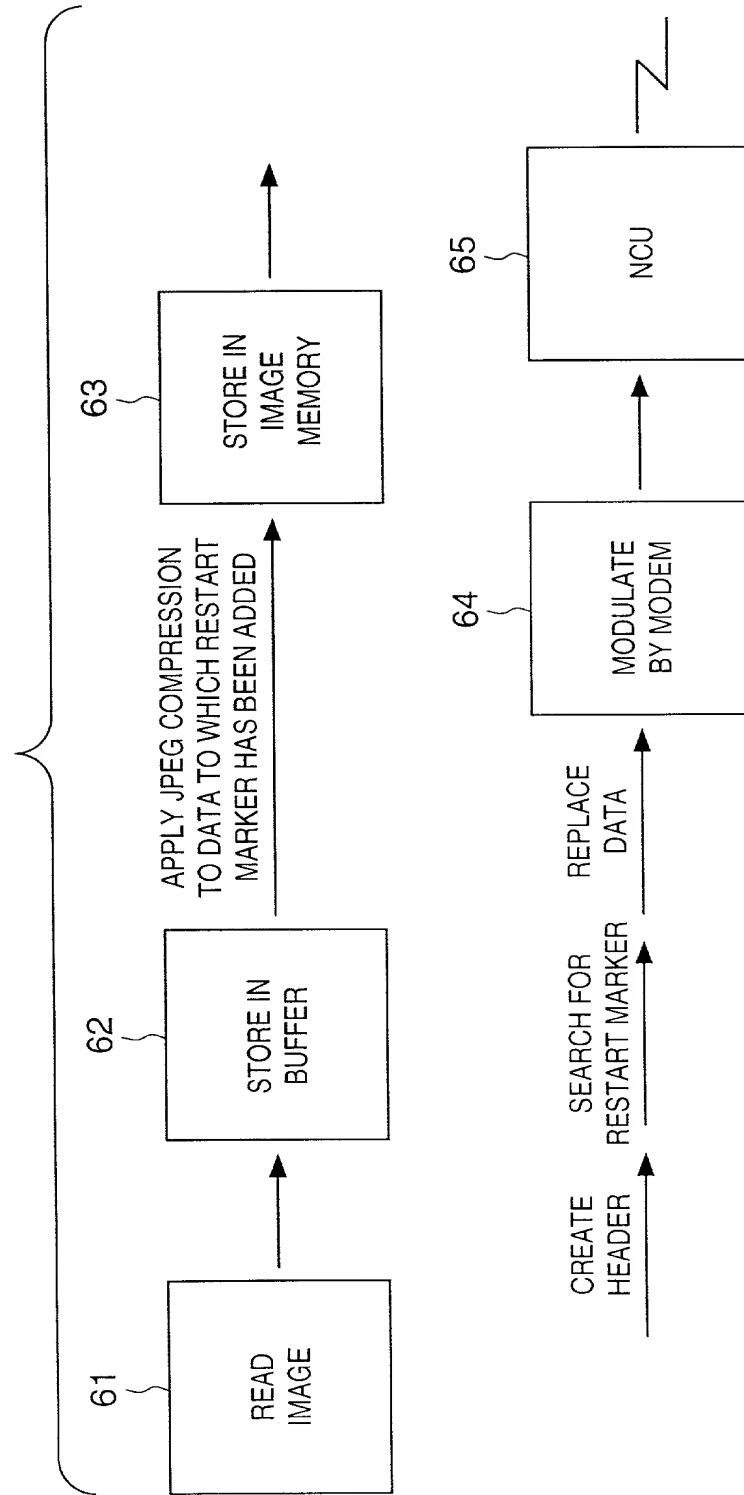
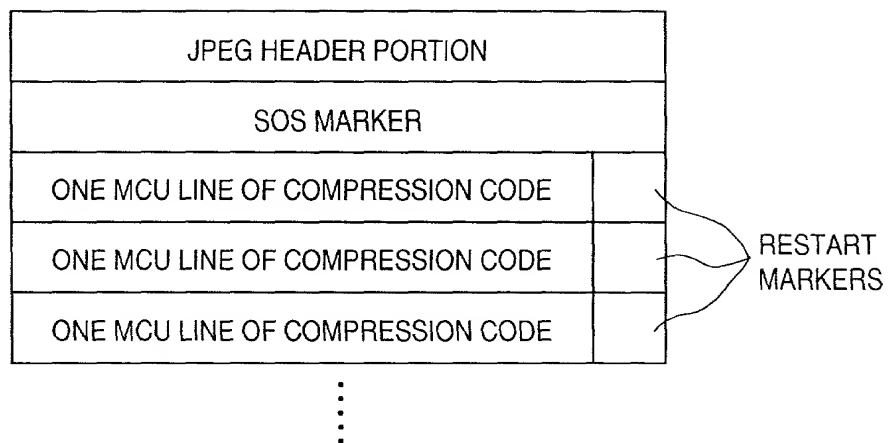
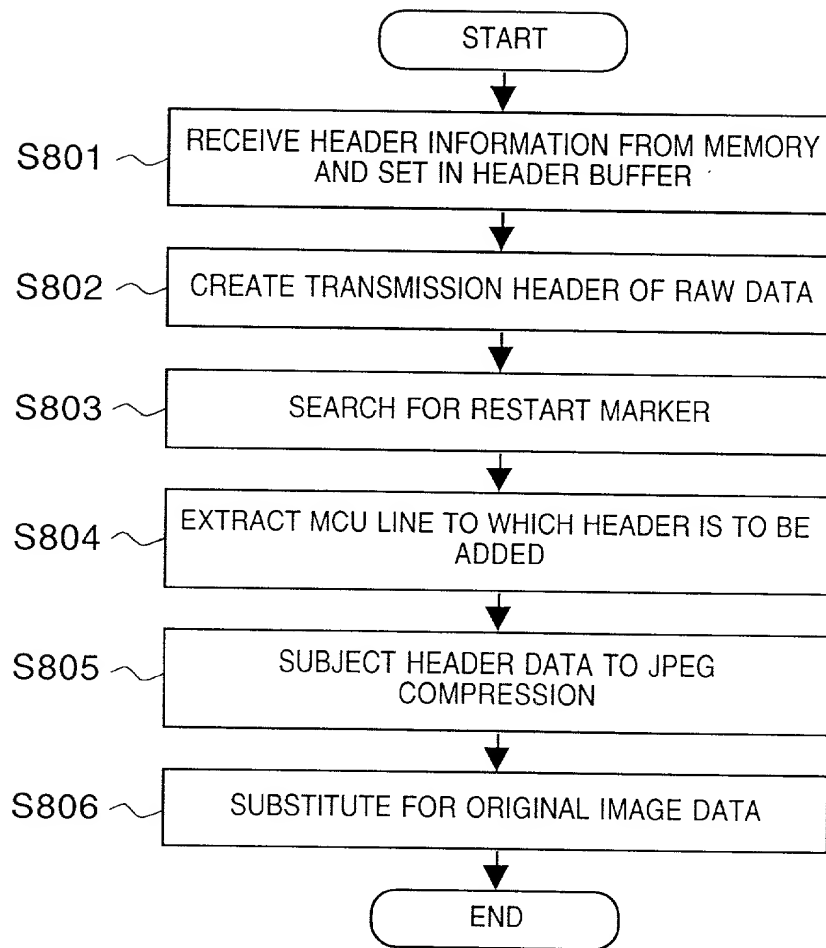
**FIG. 5**

FIG. 6



**FIG. 7**



**FIG. 8**

**COMBINED DECLARATION AND POWER OF ATTORNEY  
FOR PATENT APPLICATION**  
(Page 1)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

IMAGE COMMUNICATION APPARATUS AND METHOD

the specification of which [ X ] is attached hereto. [ ] was filed on \_\_\_\_\_

as United States Application No. or PCT International Application No. \_\_\_\_\_  
and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b), of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designates at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed:

| <u>Country</u> | <u>Application No.</u> | <u>Filed (Day/Mo./Yr.)</u> | <u>(Yes/No)<br/>Priority Claimed</u> |
|----------------|------------------------|----------------------------|--------------------------------------|
| JAPAN          | 11-186882              | 30/06/1999                 | Yes                                  |

I hereby appoint the practitioners associated with the firm and customer number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to the address associated with that Customer Number:

**FITZPATRICK, CELLA, HARPER & SCINTO**  
**Customer Number: 05514**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole or First Inventor Daiki KADOMATSU

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